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THERMAL ELECTRIC TOOTHBRUSH

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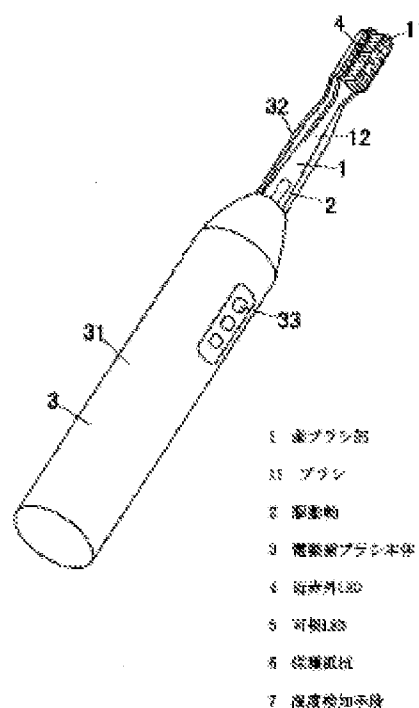
## Abstract

### Problem

To provide an electric toothbrush with which desired toothpastes can be used which imparts a warming sensation to the gums during brushing.

### Means to solve

An electric toothbrush consisting of toothbrush part 1 having brush 11, electric toothbrush main body 3 having drive shaft 2 for attaching/detaching toothbrush part 1. It is furnished with an irradiating means for imparting a warming sensation to the dental stem/gums by radiating near-infrared rays.



### Legend:

- 1 Toothbrush part
- 2 Drive shaft
- 3 Electric toothbrush main body
- 4 Near-infrared LED
- 5 Visible LED
- 6 Protective impedance
- 7 Temperature detecting means
- 11 Brush

### Claims

1. A thermal electric toothbrush characterized in that the electric toothbrush comprises a toothbrush part and a main body having the attachable/detachable toothbrush part inserted while being furnished with an irradiating means for imparting a warming sensation to the gums by radiating near-infrared rays.

2. The thermal electric toothbrush described in Claim 1, characterized by comprising the irradiating means and the main body of the electric toothbrush as one unit.

3. The thermal electric toothbrush described in Claim 1, characterized by comprising the irradiating means and the toothbrush part as one unit.

4. The thermal electric toothbrush described in any of Claims 1-3, characterized in that the brush is attachable/detachable to and from the toothbrush part.

5. The thermal electric toothbrush described in any of Claims 1-4, characterized in that the irradiating means is a near-infrared LED.

6. The thermal electric toothbrush described in any of Claims 1-5, characterized in that the near-infrared LED is operated by a pulse current.

7. The thermal electric toothbrush described in any of Claims 1-6, characterized by being equipped with a display means for the operating condition of the near-infrared LED.

8. The thermal electric toothbrush described in Claim 7, characterized by equipping the display means for the operating condition of the near-infrared LED at least at the main body of the electric toothbrush or the toothbrush part.

9. The thermal electric toothbrush described in Claim 7 or 8, characterized in that the display means for the operating condition of the near-infrared LED is a visible LED.

10. The thermal electric toothbrush described in any of Claims 5-9, characterized in that protective impedance for the near-infrared LED is equipped close to the near-infrared LED.

11. The thermal electric toothbrush described in any of Claims 5-10, characterized by being equipped with a temperature detecting means for the near-infrared LED.

### Detailed explanation of the invention

[0001]

#### Technical application of the invention

The present invention pertains to a thermal electric toothbrush which imparts a warming sensation to the gums by radiating infrared rays on the gums.

[0002]

Prior art

The conventional means for imparting a warming sensation to the gums include massaging devices for the gums which use warm water by employing a water flow (water pressure) and toothpastes formulated with chemical ingredients that generate heat by absorbing water.

[0003]

Gums with gingivitis have worsened microcirculation function compared to healthy gums, and it was reported that the more progressive the gingivitis is, the lower the surface temperature of the tooth gums, because the surface temperature of the gums is regulated mainly by the quantity of blood flow in the blood capillary network. The toothpastes formulated with the chemical ingredients described earlier are products used in an attempt to improve the condition of gingivitis by recovering the microcirculation function by increasing the temperature of the gums to about 40°C by generating heat thorough contact with the moisture in saliva combined with the synergetic effect from massaging with a toothbrush.

[0004]

However, warm water must be constantly on hand with a gums massaging machine using water flow (water pressure), and maintaining constant temperature is also difficult. Also, the toothpastes formulated with the chemical ingredients are in general marketed by filling them in tubes with caps, and by opening and closing the caps numerous times, chemical changes occur to the chemical ingredients and the warming effect is reduced when the toothpaste comes in contact with the air, particularly when the caps are not closed tightly. An additional drawback for the toothpastes is that consumers have different preferences for the flavor and viscosity and one may not be able to find one such toothpaste he/she likes.

[0005]

Problems to be solved by the invention

This invention is designed by focusing on the aforementioned aspects and the objective lies in providing an electric toothbrush with which desired toothpastes can be used which also imparts a warming sensation to the gums when brushing teeth.

[0006]

Means to solve the problems

The electric toothbrush of the present invention for solving the aforementioned problems is characterized in that the electric toothbrush consists of toothbrush part 1 having brush 11, and electric toothbrush main body 3 having drive shaft 2 for attaching/detaching toothbrush part 1 which is equipped with an irradiating means for imparting a warming sensation to the gums by irradiating them with near-infrared rays. A warming sensation can be imparted by using the electric toothbrush with said constitution to brush teeth while radiating near-infrared rays simultaneously onto the gums.

[0007]

Also, the irradiating means and electric toothbrush main body 3 are preferably one unit. Toothbrush part 1 and the irradiating means can be separated in a product with such a constitution and toothbrush part 1 solely can be replaced as a disposable part as is usually done while leaving the irradiating means as is.

[0008]

Also, the irradiating means and toothbrush part 1 preferably form one unit. Toothbrush part 1 can double as the irradiating means by such constitution.

[0009]

Also, brush 11 is preferably attachable and detachable to and from toothbrush part 1. By such an arrangement, brush 11 can be replaced as a disposable part while leaving the irradiating means as is.

[0010]

Also, near-infrared LED 4 is preferably used as the irradiating means. Highly efficient irradiation with directivity can be achieved with such an arrangement.

[0011]

Also, near-infrared LED 4 is preferably operated with a pulse current. Consumption of electricity can be reduced with such an arrangement.

[0012]

Also, at least electric toothbrush main body 3 or toothbrush part 1 is furnished with a display means for the operating condition of near-infrared LED 4. The operating condition can be verified by the user by such a constitution.

[0013]

Also, the display means for the operating condition is preferably visible LED 5. The operating condition can be verified at one glance with such an arrangement.

[0014]

Also, protective impedance 6 of near-infrared LED 4 is preferably equipped close to near-infrared LED 4. The heat produced by protective impedance 6 can be transferred to the gums and a warming sensation can be imparted by such a constitution.

[0015]

Also, temperature detecting means 7 is preferably furnished for near-infrared LED 4. Overheating of near-infrared LED 4 can be prevented by such arrangement.

[0016]

Application examples of the invention

The present invention is explained with the following application examples using the figures attached.

[0017]

Figure 1 is an oblique view of the electric toothbrush of the present application example. The electric toothbrush consists of electric toothbrush main body 3 having a motor (not shown in the figure) and toothbrush part 1 attachable and detachable to and from electric toothbrush main body 3.

[0018]

Electric toothbrush main body 3 of the application example shown in Figure 1 consists of grip part 31 and arm 32 protruding in the axial direction from the longitudinal end of grip part 31. Also, drive shaft 2 protrudes into arm 32 from grip part 31. A motor (not shown in the figure) and a movement converting mechanism (not shown in the figure) are housed inside grip part 31 which is furnished with switch 33 for operating toothbrush part 1. A plural number of near-infrared LEDs 4 are furnished at the tip of arm 32 as the irradiating means for imparting a

warm sensation to the gums by irradiating near-infrared rays, and print pattern for connecting an electric circuit (not shown in the figure) and near-infrared LED 4 are also furnished.

[0019]

Toothbrush part 1 consists of brush 11 and stem 12 in that brush 11 is equipped at the longitudinal end of stem 12 vertically to the longitudinal direction. Also, a connecting part (not shown in the figure) is furnished at the other end of stem 12 for connecting to drive shaft 2. Toothbrush part 1 is attached and detached freely to and from electric toothbrush main body 3 by connecting the linking part of stem 12 and drive shaft 2, and certain movements such as the brush movement or the rolling movement of toothbrush part 1 are performed by operating switch 33. The back of toothbrush part 1 lines up alongside arm 32 when toothbrush part 1 is attached to electric toothbrush main body 3, and near-infrared LED 4 is situated on the two sides of brush 11. This is arranged so that the near-infrared rays can radiate onto the gums without being blocked while brushing teeth. Also, the width of arm 32 is about the same as the width of stem 12 which is arranged so that arm 32 will not be in the way when brushing teeth.

[0020]

The output of near-infrared LED 4 is set such that the temperature of the gums is maintained at 40°C, and luminescent diode DNP318U-4 having a central wavelength of 880 nm for luminescent light produced by Stanley K.K. is used, taking into consideration the fact that the longer the wavelength is, the easier the absorption and that the shorter the wavelength is, i.e. the closer to visible light, the higher the transmission into the body, but it is not to be construed as a limitation.

[0021]

Through the aforementioned constitution, a warming sensation can be experienced by the user simply without the need of preparing warm water because the near-infrared rays emitted from near-infrared LED 4 are radiated onto the gums while brushing teeth or massaging the gums with the electric tooth brush. Also, toothbrush part 1 which is the driving part and near-infrared LED 4 are separable and toothbrush part 1 can be replaced as a disposable part as is usually done and the near-infrared LED can be used continuously.

[0022]

In this regard, the present application example is designed such that the movement of toothbrush part 1 is started while irradiation of near-infrared rays begins simultaneously, but the switch for controlling near-infrared LED 4 may be equipped separately; for example, irradiation



is stopped during brushing (when not massaging the gums). Also, because near-infrared LED 4 is operated by a pulse current, consumption of electricity is reduced and a large amount of current can be supplied instantly compared to flowing electric current constantly so that transmission of near-infrared rays in the gums can be increased and a warming sensation can be imparted onto the gums.

[0023]

Next, another application example is explained based on Figure 2. In the previous application example, near-infrared LED 4 is equipped on the side of electric toothbrush main body 3 by furnishing arm 32, but electric toothbrush main body 3 of the present application example consisting of only grip part 31 and near-infrared LED 4 is equipped in toothbrush part 1.

[0024]

The electric toothbrush of the present application example consists of electric toothbrush main body 3 and toothbrush part 1. Toothbrush part 1 consists of brush 11 and upper stem part 12a and attachment 8. One end of attachment 8 is equipped with connecting part 81 for connecting to drive shaft 2, which allows the attachment and detachment of toothbrush part 1 to and from electric toothbrush main body 3. Also, a connecting part (not shown in the figure) is equipped on the other end of attachment 8 for connecting to upper stem part 12a which is attachable and detachable to and from upper stem 12a.

[0025]

An attaching part (not shown in the figure) is furnished at the tip of upper stem part 12a for attaching toothbrush 11 for which concave part 13 is furnished on the back. Fitting part 14 for near-infrared LED 4 is equipped in concave part 13 and near-infrared LED 4 is immobilized on upper stem part 12a by fitting near-infrared LED 4 on said fitting part 14 and closing back plate 15.

[0026]

A plural number of housing spaces 16 are equipped in toothbrush 11 which serve as the openings for passing near-infrared rays radiated from near-infrared LED 4 fitted on upper stem 12a as well as for housing the end part of the package of near-infrared LED 4. With said arrangement, brush 11 can be attached and detached freely to and from upper stem part 12a without interfering with the radiation of near-infrared rays onto the gums from near-infrared LED 4.

[0027]

Also, lead wire 9 is extended to upper stem part 12a to link near-infrared LED 4 and the electric circuit (not shown in the figure) by passing into attachment 8 through the connecting part of attachment 8 and further through lead wire guiding part 82 of attachment 8 while also being introduced into grip part 31 through lead wire guiding part 34 of grip part 31.

[0028]

The aforementioned constitution makes it possible for toothbrush part 1 to serve also as the part for fitting near-infrared LED 4 comprising the means for radiating near-infrared rays onto gums. Also, brush 11 solely is treated as a disposable part while leaving the means for radiating near-infrared rays as is because brush 11 is fitted by freely attachable and detachable means to and from toothbrush part 1. In this respect, attachment of brush 11 on upper stem part 12a may be by any means including fitting and inserting.

[0029]

Next, still another application example is described based on Figure 3. In the previous application example, lead wire 9 is furnished for serving as the means for connecting near-infrared LED 4 fitted on toothbrush part 1 and the electric circuit housed inside electric toothbrush main body 3. However, instead of furnishing lead wire 9, electrode 10 is equipped at the connecting part of stem 12 to grip 31 of stem 12 and an electrode (not shown in the figure) is also equipped at connecting part of grip 31 to stem 12 in the present application example, and electricity is supplied to near-infrared LED 4 in toothbrush part 1 when the two electrodes 10 come in contact with each other when toothbrush part 1 is fitted onto electric toothbrush main body 3.

[0030]

The wiring connection of near-infrared LED 4 and the electric circuit housed inside electric toothbrush main body 3 is made easier by the aforementioned constitution compared with the previously described constitution.

[0031]

Near-infrared LED 4 for radiating near-infrared rays onto gums, visible LED 5 for monitoring the operating condition of near-infrared LED 4 and protective impedance 6 of visible LED 5 are equipped in toothbrush part 1 shown in Figure 4. In case near-infrared LED 4 malfunctions or the illuminating intensity of near-infrared LED 4 is reduced for some reason, the user will be notified of the condition from the light of visible LED 5 being out or blinking.

[0032]

The aforementioned constitution enables the user of the electric toothbrush to verify the operating condition of the near-infrared rays not seen by the eye, and the energy produced by protective impedance 6 is used to impart a warming sensation to the gums.

[0033]

In this regard, visible LED 5 for verifying the operating condition of near-infrared LED 4 is equipped in toothbrush part 1 together with near-infrared LED 4, but it can also be equipped in electric toothbrush main body 3. Also, notification devices that provide sounds such as buzzers can be used instead of visible LED 5.

[0034]

Thermistor 7 as a means for detecting the temperature of near-infrared LED 4 is equipped in toothbrush part 1 shown in Figure 5 which is designed in such a way that in case near-infrared LED 4 shows an abnormal temperature increases for some reasons, thermistor 7 will detect the abnormal condition and stops the supply of electricity to near-infrared LED 4 or the action of the electric toothbrush itself.

[0035]

Burn injuries to the mouth due to temperature increases of near-infrared LED 4 can be prevented by the aforementioned constitution.

[0036]

Also, it is obvious that the materials for brush 11 used in the aforementioned application examples may vary depending on the objective to provide optimum effects, for example using nylon products for brushing teeth and silicone products for massaging gums.

[0037]

Effect of the invention

According to the invention described in Claim 1 of the present invention, a warming sensation can be simply imparted to a user without preparing warm water and microcirculation function can be recovered by the synergetic effect from massaging with the toothbrush and prevention/treatment efficacy on gingivitis can be expected from the electric toothbrush because it is equipped with an irradiating means for imparting the warming sensation to the gums by irradiating near-infrared rays, and because the near-infrared rays emitted from the irradiating

means can irradiate the gums naturally when the electric toothbrush is used to brush the teeth or massage the gums.

[0038]

Also, according to the invention described in Claim 2, in addition to the aforementioned effect of the invention of Claim 1, the toothbrush part and the irradiating means are separated and the toothbrush part can be replaced as a disposable part as is usually done to reduce the cost because the irradiating means and the electric toothbrush brush main body are one unit.

[0039]

Also, according to the invention described in Claim 3, in addition to the aforementioned effect of the invention of Claim 1, the toothbrush part doubles as the special part for equipping the irradiating means and the portion inserted into the mouth when brushing teeth is slender and difficult application in the narrow area in the back of the mouth can be performed without using a special arm because the irradiating means and the toothbrush part are one unit.

[0040]

Also, according to the invention described in Claim 4, in addition to the aforementioned effect of any of the inventions of Claims 1-3, the brush can be replaced solely as a disposable part while leaving the irradiating means as is and electric toothbrush main body 3 can be shared by the entire family, which becomes very economical because the brush can be freely attached and detached to and from the toothbrush part.

[0041]

Also, according to the invention described in Claim 5, in addition to the aforementioned effect of any of the inventions of Claims 1-4, a miniaturized, direct and highly efficient irradiating means can be obtained because a near-infrared LED is used as the irradiating means.

[0042]

Also, according to the invention described in Claim 6, in addition to the aforementioned effect of any of the inventions of Claims 1-5, the consumption of electricity is low and the transmission in the gums is high because the near-infrared LED is operated by a pulse current.

[0043]

Also, because a display means for the operating condition of the near-infrared LED is furnished according to the inventions in Claims 7 and 8, a user can verify the operating condition of the near-infrared rays which are not visible to the naked eye.

[0044]

Also, according to the invention described in Claim 9, in addition to the aforementioned effect of the invention of Claim 7 or 8, the operating condition can be verified by one glance because a visible LED is used as the display means for the operating condition.

[0045]

Also, according to the invention described in Claim 10, in addition to the aforementioned effect of any of the inventions of Claims 5-9, a better warming sensation can be provided by employing the heat energy produced by the protective impedance because the protective impedance for the near-infrared LED is equipped close to the near-infrared LED.

[0046]

Also, according to the invention described in Claim 11, in addition to the aforementioned effect of any of the inventions of Claims 5-10, burn injuries to the mouth due to overheating of the near-infrared LED can be prevented because a temperature detecting means for the near-infrared LED is furnished.

#### Brief description of the figures

Figure 1 shows an oblique view of an application example of the present invention.

Figure 2 shows an exploded oblique view of another application example of the present invention.

Figure 3 shows an exploded oblique view of the toothbrush part of still another application example of the present invention.

Figure 4 shows an exploded oblique view of the toothbrush part of still another application example of the present invention.

Figure 5 shows an exploded oblique view of the toothbrush part of still another application example of the present invention.

#### Explanation of the reference symbols

- 1      Toothbrush part
- 11     Brush

- 2 Drive shaft
- 3 Electric toothbrush main body
- 4 Near-infrared LED
- 5 Visible LED
- 6 Protective impedance
- 7 Temperature detection means

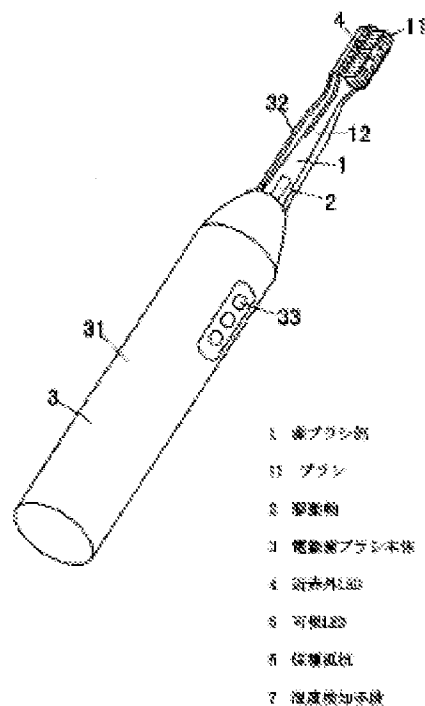


Figure 1

## Legend:

- 1 Toothbrush part
- 2 Drive shaft
- 3 Electric toothbrush main body
- 4 Near-infrared LED
- 5 Visible LED
- 6 Protective impedance
- 7 Temperature detection means
- 11 Brush

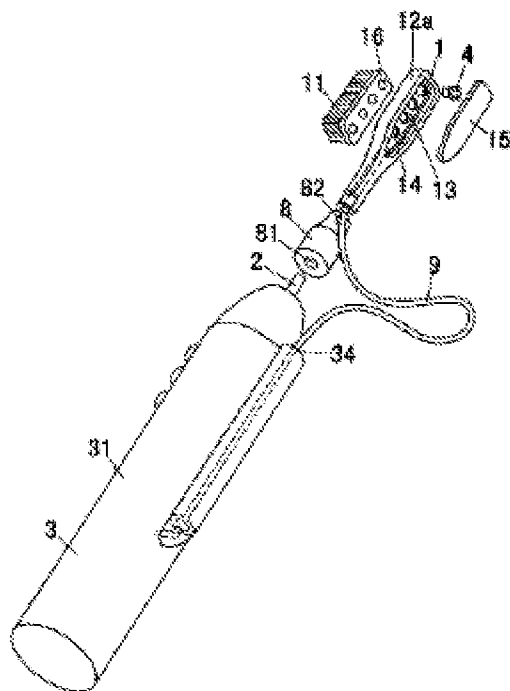


Figure 2

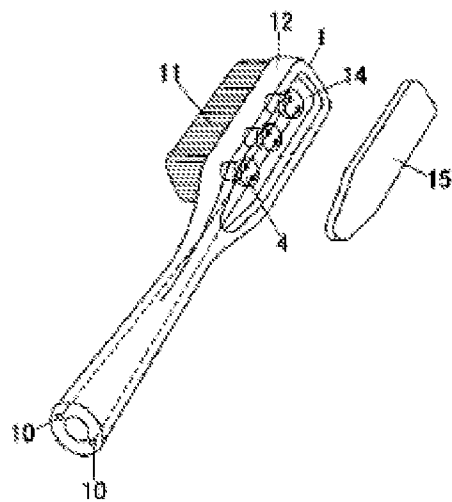


Figure 3

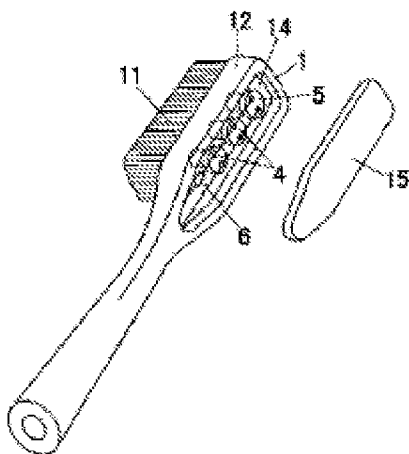


Figure 4

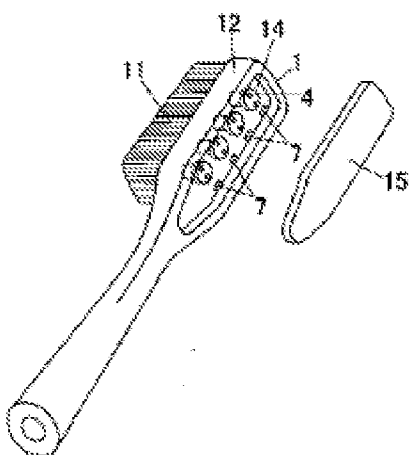


Figure 5